ASSESSMENT OF QUEBEC COASTAL WATERS WHELK STOCKS IN 2011

Source: DFO 2009

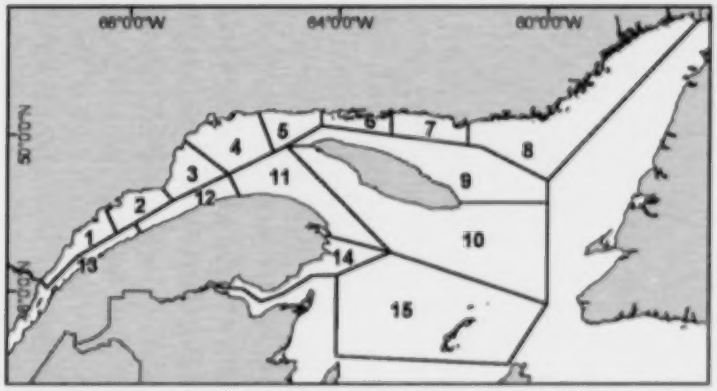

Figure 1. Whelk management areas in Quebec.

Context

The whelk commercial fishery began in the Estuary and Gulf of St. Lawrence in the 1940s. In the early 1990s, it expanded to the North Shore, and in 2003 it began in the Îles-de-la-Madeleine. The whelk fishery is an inshore activity that is practised using conical or pyramid-type traps. It focuses essentially on Buccinum undatum, although some other species of Buccinum are present in the Estuary and Gulf of St. Lawrence. Quebec waters are divided into 15 fishing areas. The fishery is regulated in all areas by controlling the number of licences, the number and size of traps as well as the minimum legal size of 70 mm. Quotas on landings are in place in areas 1, 2, 11, 12, 13 and 15.

Resource assessments are done every three years and the last stock review goes back to the winter of 2009. The main indicators used for stock follow-ups are landings, fishing effort, catches per unit of fishing effort and harvest size structure.

This Science Advisory Report is from the Fisheries and Oceans Canada Canadian Science Advisory Secretariat Regional Advisory Meeting of February 6, 2012, on Assessment of Quebec Coastal Waters Whelk Stocks.

SUMMARY

- In 2011, whelk landings totalled 1360 t in Quebec. A total of 68% of these landings were from the North Shore, 12% from the Gaspé Peninsula–Lower St. Lawrence and 20% from the Îles-de-la-Madeleine. Since 2006, landings have fluctuated between 1147 and 1587 t according to the variations in the fishing effort.
- Since 2006, catches per unit effort (CPUE) have increased in areas 5, 6 and 13, have been relatively stable in areas 1, 3, 4, 12 and 15, have dropped in areas 7 and 11, and have

varied in areas 2 and 8. However, in areas 1, 3, 11 and 15, CPUEs were below their respective reference averages in 2011.

- Since 2006, mean sizes have been roughly stable in all areas. In 2011, the proportion of whelk measuring less than the legal limit in landings was less than 6% everywhere except in areas 2 (21%) and 8 (32%). The harvest of sexually immature individuals can also have negative impacts on the resource. It is therefore recommended that the minimum legal size be maintained in all areas.

- Stock status has been generally stable since 2006; this suggests that the current harvest rate is sustainable. We recommend directly controlling the fishing effort in all areas and limiting it to the average of the three highest values in the 2006–2011 series. If there is no fishing effort control, the rule stated above may be applied to landings. In the special case of areas 7 and 11 where the fishery is focused on only a small area, it would be better to explore and expand the fishing ground.

BACKGROUND

The Waved Whelk, *Buccinum undatum*, is a gastropod mollusc that is found along the western Atlantic coast from New Jersey to Labrador, including the Estuary and Gulf of St. Lawrence. It is common in cold waters from the subtidal area (below the low water boundary) to depths of 30 metres or more. Whelk is a necrophagous predator, feeding mainly on invertebrates such as polychaetes, molluscs and echinoderms. According to the literature, its life span is approximately 15 years. In the St. Lawrence, it can reach a shell height of 120–130 mm. Whelk can move quite fast (15 cm/min), covering several dozen metres when food or predators are present.

In whelk, the sexes are separated and the sex ratio is roughly balanced. The mean size at which 50% of individuals reach sexual maturity varies depending on sex and between fishing areas. It is generally greater for females. This mean size is 66.5 mm for males and 71.8 mm for females for all fishing areas studied.

Whelk fertilization takes place internally. On the North Shore and in the Gaspé Peninsula, the mating season occurs in May and June. The eggs are laid two to three weeks after mating, mostly in June and July. Egg-laying is generally collective; females assemble to lay eggs on one site. Eggs are enclosed in chitin capsules that are clumped together in a mass of several centimetres and attached to the substrate. There is no planktonic larval stage. In the Estuary and northern Gulf of St. Lawrence, juveniles emerge from the capsules after five to eight months of development (November to February) and are about 2–3 mm in size.

Adults lead a rather sedentary life. They spend most of their time immobile and half buried in sediments. Evidence suggests that this behaviour, together with the absence of a larval phase, limits exchanges with adjoining populations and the possibility of rapidly recolonizing overexploited sites.

RESOURCE ASSESSMENT

There are 15 whelk management areas in Quebec waters. Areas 1 to 8 are along the North Shore, areas 9 and 10 along Anticosti Island, areas 11 to 14 along the Lower St. Lawrence and the Gaspé Peninsula, and area 15 along the Îles-de-la-Madeleine (Figure 1). Area 10 has not been exploited since 1997. A few harvesters visited areas 9 and 14 between 2002 and 2006, but there has been no harvesting since. There were 253 whelk fishing licence holders in 2011; however, only 70 were active. Since 2005, the minimum legal size has been 70 mm everywhere in Quebec. The fishing season, which lasts six months in all fishing areas, extends from April or May to October or November. There are total allowable catches (TAC) in areas 1 and 2 (North Shore) of 491 and 109 t, respectively. These preventive TACs have not been reached since 2004. In the Gaspé Peninsula–Lower St. Lawrence, TACs were implemented in 2010 and were 32 t in area 11, 128 t in area 12 and 73 t in area 13 in 2011. In the Îles-de-la-Madeleine (area 15), the TAC has been 450 t since 2006.

Whelk landings in Quebec peaked in 2003 (2000 t of live weight) with the introduction of the fishery in the Îles-de-la-Madeleine (Figure 2). Since 2006, landings have fluctuated between 1147 and 1587 t (Table 1). In 2011, they were 1360 t and 68% of them were from the North Shore, 12% from the Gaspé Peninsula–Lower St. Lawrence and 20% from the Îles-de-la-Madeleine. That same year, landings dropped by 18% on the North Shore, increased by 15% in the Gaspé Peninsula–Lower St. Lawrence and dropped by 15% in the Îles-de-la-Madeleine compared to their respective reference averages.

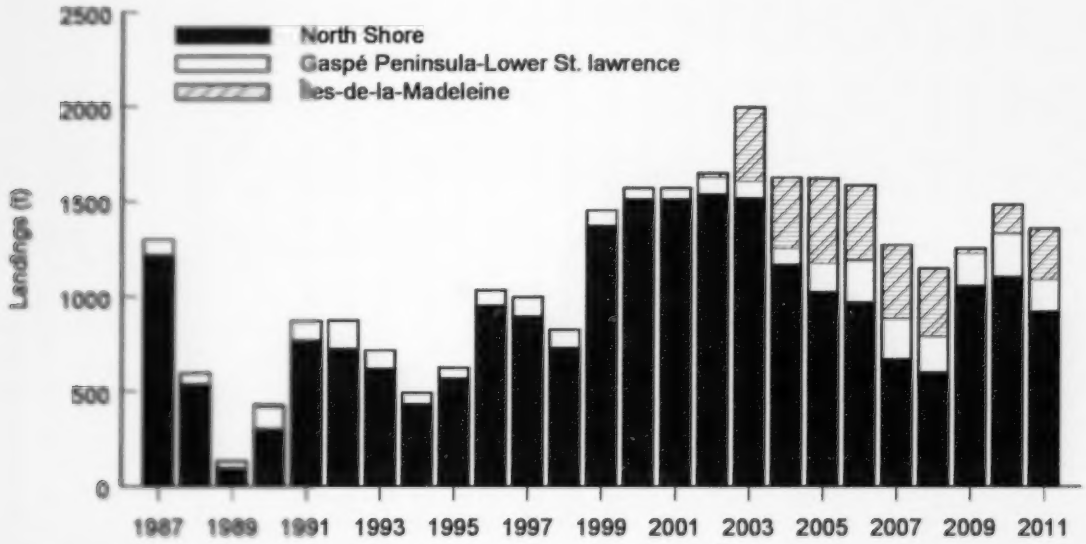

Figure 2. Whelk landings per region from 1987 to 2011.

Fishing effort reached a maximum value of 384 924 trap hauls in 2003 (Table 2). It then dropped to 206 807 trap hauls in 2008 and reached 228 175, 259 955 and 213 470 trap hauls in 2009, 2010 and 2011, respectively. In 2011, it dropped by 28% on the North Shore and 26% in the Gaspé Peninsula–Lower St. Lawrence but was stable in the Îles-de-la-Madeleine compared to the respective reference averages for these areas. The variations in landings observed in each fishing area since 2006 are largely due to changes in fishing effort and changes related to socioeconomic

factors rather than abundance fluctuations of the resource. Since 2009, fewer than four fishers were active in areas 2, 3, 7 and 11.

Table 1. Whelk landings (t) per fishing area, region and for all of Quebec from 2000 to 2011 with reference average.

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average [1]
North Shore													
1	550	589	594	408	204	202	247	151	118	300	204	132	302
2	207	157	132	119	71	72	39	cd [2]	cd	cd	cd	cd	73
3	18	52	cd	33	39	30	28	14	cd	cd	cd	cd	25
4	108	162	143	149	161	114	107	83	48	51	60	42	108
5	401	359	310	385	322	272	221	168	146	274	363	312	282
6	184	201	243	282	279	193	196	152	216	330	358	314	245
7	cd		cd	60	cd	cd	90	cd	cd	cd	cd	cd	56
8	37	cd	6	90	7	63	47	21	24	11	38	21	31
9						cd	cd						cd
Gaspé Peninsula–Lower St. Lawrence													
11	cd	cd	29	25	cd	44	34	cd	4	cd	cd	cd	19
12	cd	cd	32	34	39	84	150	127	117	110	129	89	83
13	8	cd	23	27	cd	24	34	77	67	57	91	78	44
14			cd	cd	cd								cd
Îles-de-la-Madeleine													
15			cd	388	369	442	392	382	352	cd	150	265	312
Quebec [3]	1571	1573	1649	2000	1628	1623	1587	1269	1147	1255	1484	1360	1522

[1] 2001–2010 reference average, except for area 15, where the 2003–2010 average was calculated.
[2] cd: confidential data (three or fewer fishers).
[3] Total for all fishing areas.

CPUEs determined from logbooks differ between fishing areas (Table 3). The highest values are observed in the Îles-de-la-Madeleine, with a 2003–2010 average of 21.8 kg/trap. The commercial fishery is still in development there. Elsewhere in Quebec, average CPUEs from 2001 to 2010 are below 10 kg/trap and the 2006–2011 trends vary with fishing area. During this period, CPUEs in areas 5, 6 and 13 increased, reaching 6.3, 5.1 and 8.8 kg/trap, respectively, in 2011. In areas 1, 3, 4, 12 and 15, CPUEs were relatively stable, with values of 6.8, 3.2, 3.8, 4.4 and 18.9 kg/trap, respectively, in 2011. They dropped in areas 7 and 11, where these values were 4.9 and 1.1 kg/trap, respectively. Lastly, CPUEs varied in areas 2 and 8; there was no clear trend. However, in areas 1, 3, 11 and 15, CPUEs in 2011 were below their respective reference averages.

Table 2. Fishing effort (number of trap hauls) per fishing area, region and for all of Quebec from 2002 to 2011 with reference average.

Area	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg.[1]
North Shore											
1	50,580	43,310	29,648	27,755	32,085	22,413	15,261	33,022	28,801	19,623	31,430
2	14,406	11,198	7935	10,532	5102	cd[2]	cd	cd	cd	cd	7072
3	cd	5578	6783	6066	4916	3031	cd	cd	cd	cd	4038
4	47,579	54,704	53,687	41,556	35,427	24,916	16,171	14,837	18,795	10,687	34,186
5	88,260	109,727	106,330	85,340	65,995	54,020	40,048	62,345	75,874	54,995	76,438
6	47,881	70,830	88,728	73,828	64,772	47,180	57,114	64,017	63,995	63,625	64,260
7	cd	12 968	cd	cd	10 995	cd	cd	cd	cd	cd	9014
8	481	26,097	1997	14,431	16,032	5395	7497	2331	13,113	6704	9708
9				cd	cd						cd
Gaspé Peninsula–Lower St. Lawrence											
11	9412	14,440	cd	15 353	10 446	cd	2205	cd	cd	cd	7409
12	9134	12,450	13,132	26,664	37,353	32,335	32,067	26,562	27,973	19,601	24,186
13	5100	8002	cd	5490	6350	12,440	10,890	8454	10,107	8785	8073
14		cd	cd								cd
Îles-de-la-Madeleine											
15	cd	15 397	18 672	19 296	17 444	18 026	16 388	cd	6499	14 100	14,086
Quebec[3]	286 625	384 924	356 117	339 560	307 531	232 443	206 807	228 175	259 955	213 470	289 126

[1] 2002–2010 reference average, except for area 15, where the 2003–2010 average was calculated.
[2] cd: confidential data (three or fewer fishers).
[3] Total for all fishing areas.

Table 3. Standardized catches per unit of effort (kg of live weight/trap) of whelk per fishing area, based on logbooks and reference average.

Area	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average[1]
North Shore												
1	13.2	11.4	9.2	6.7	7.2	7.8	7.0	7.5	9.1	7.4	6.8	7.6
2	11.7	8.7	10.9	8.0	7.5	7.0	13.4	11.7	7.6	9.5	11.4	9.7
3	6.5	5.3	5.5	5.6	4.9	5.8	4.3	4.3	2.7	4.8	3.2	4.6
4	4.4	3.0	2.9	3.0	3.0	3.1	3.5	2.8	3.6	3.0	3.8	3.2
5	4.3	3.9	3.9	3.4	3.5	3.7	3.2	3.7	4.8	5.4	6.3	4.2
6	4.7	5.5	4.2	3.5	3.1	3.3	3.6	4.1	5.5	5.2	5.1	4.2
7		12.1	3.8	7.3	7.5	8.9	7.6	4.9	7.9	5.6	4.9	6.5
8		5.1	3.7	3.7	4.7	3.6	4.8	3.9	5.5	3.6	3.7	4.1
Gaspé Peninsula–Lower St. Lawrence												
11	1.2	2.4	1.6	3.2	4.1	4.4	3.2	2.0	2.4	1.3	1.1	2.6
12	3.6	2.9	2.4	2.9	3.3	4.1	4.6	3.7	4.2	4.5	4.4	3.8
13	4.4	4.1	3.4	3.8	4.4	5.1	5.8	5.7	6.2	8.3	8.8	5.7
Îles-de-la-Madeleine												
15			23.0	21.3	22.9	21.3	20.6	19.7	24.8	23.5	18.9	21.8

[1] 2001–2010 reference average, except for area 15, where the 2003–2010 average was calculated.

Since 2004, DFO's commercial sampling program has provided information on the size (shell height) of landed whelk. Since 2006, the mean size of landed whelk has been stable or slightly greater (Table 4). In 2011, it was between 73 and 91 mm depending on fishing area and was similar to or above its respective reference averages. Since 2008, the proportion of sublegal-size whelk in landings has generally been below 8% (Table 5). In 2011, this proportion was below 6% everywhere except in areas 2 and 8, where it was 21% and 32%, respectively.

Table 4. Mean size (mm) of landed whelk per fishing area from 2004 to 2011 and reference average from 2004 to 2010.

Area	2004	2005	2006	2007	2008	2009	2010	2011	Average
North Shore									
1	73	74	77	79	78	78	79	81	77
2	72	74	71	74	72	81	82	75	75
3	87								
4	87	87	83	89	89	89	90	91	88
5	81	80	80	85	85	86	89	88	84
6	81	83	87	85	83	84	86	88	84
7	82	81	84	83	87	87	87	90	84
8		77	76	76	71	74	75	73	75
Gaspé Peninsula–Lower St. Lawrence									
11	83	86	86	90	94	90	90	91	89
12	85	88	85	85	88	87	88	87	87
13	70	77	80	87	83	83	87	85	81
Magdalen Islands									
15	82	82	83	81	88	88	85	87	84

Table 5. Proportion (%) of whelk smaller than the minimum legal size (70 mm) in commercial landings per fishing area from 2004 to 2011.

Area	2004	2005	2006	2007	2008	2009	2010	2011
North Shore								
1	38	29	19	8	15	14	12	5
2	43	30	41	27	43	3	6	21
3	2							
4	6	4	14	3	3	3	2	2
5	14	11	15	6	4	2	2	1
6	13	10	3	4	6	6	2	2
7	9	9	4	10	5	4	7	2
8		27	26	27	40	32	27	32
Gaspé Peninsula–Lower St. Lawrence								
11	10	3	5	2	< 1	1	< 1	< 1
12	11	3	4	3	2	2	3	3
13	48	16	9	1	6	6	2	< 1
Îles-de-la-Madeleine								
15	8	8	4	7	2	1	2	1

A research survey has been conducted every two years since 2005 in the Forestville, Pointe-aux-Outardes and Baie-Comeau sectors on the Upper North Shore (areas 1 and 2). The surveys were conducted using a Digby scallop dredge and the four baskets were doubled with 19-mm Vexar™ meshing. More than 99% of the whelk harvested belonged to the *Buccinum undatum* (waved whelk) species. Only a few *B. glaciale*, *B. scalariforme* and *B. totteni* individuals were found during the surveys. In 2011, the relative densities of harvested whelk >20 mm varied between 0 and 1.1 whelk/m^2 according to the station. The mean density of whelk by size class, area and year is presented in Table 6. In Forestville, the densities of legal-size whelk (≥ 70 mm) in 2011 were similar to those in 2005, but higher than those in 2007 and 2009. They were similar in the four survey years in Pointe-aux-Outardes. In Baie-Comeau, the densities of legal-size whelk in 2011 were similar to those in 2005 and 2007. An assessment of whelk egg deposits was also conducted during these surveys. The density of egg masses was greater than 0.6 masse/m^2 in the Pointe-aux-Outardes and Baie-Comeau sectors and less than or equal to 0.02 masse/m^2 in Forestville. The size of harvested whelk varied between 12 and 105 mm in 2005, between 10 and 112 mm in 2007, between 9 and 103 mm in 2009 and between 11 and 106 mm in 2011. In that year, individuals measuring less than 50 mm were relatively abundant in Forestville and Pointe-aux-Outardes.

Table 6. Mean density of whelk by size class, sector and year and mean density and weight of egg masses by sector and year obtained during research surveys.

	Density (number/m^2 ± 95% confidence interval)			Mean weight (g)
Sector and year	≥ 20 mm	≥ 70 mm	Egg mass	Egg mass
Forestville				
2005	6.6 ± 1.0	3.3 ± 0.5	0.02 ± 0.04	
2007	5.5 ± 0.8	2.4 ± 0.3		
2009	6.5 ± 1.1	1.9 ± 0.3	0.01 ± 0.01	51
2011	12.2 ± 2.1	2.9 ± 0.4	0.02 ± 0.01	222
Pointe-aux-Outardes				
2005	3.3 ± 1.6	1.9 ± 1.4	1.0 ± 0.7	
2007	4.2 ± 1.6	2.8 ± 1.1		
2009	4.7 ± 1.4	2.0 ± 0.1	1.1 ± 0.9	69
2011	12.0 ± 4.7	3.3 ± 1.3	1.4 ± 1.3	77
Baie-Comeau				
2005	42.7 ± 28.3	7.8 ± 7.2	1.5 ± 2.2	
2007	21.7 ± 9.2	6.4 ± 2.8		
2009	24.3 ± 12.3	6.0 ± 2.8	0.6 ± 0.4	72
2011	41.7 ± 18.2	16.4 ± 8.8	4.2 ± 4.2	130

Sources of Uncertainty

Because of the absence of independent indicators for almost all fishing areas, such as those from the research surveys, the advice formulated for whelk is entirely dependent on the quality of the data from logbooks and from sampling of the commercial catch. Data that are partial or not reflecting reality (e.g., a number of retrieved traps different from that registered in the logbook) would affect indicator values. Since in several areas whelk fishing is a complementary activity, the fishing effort is sometimes variable during the season and from year to year. The arrival of amateur fishers or the departure of experienced fishers can affect catch rates. Environmental

conditions such as water temperature can also affect the performance of the fishery. Consequently, the actual status of the resource could be different from our interpretation and recommendations that are not completely aligned with reality.

CONCLUSION AND ADVICE

Whelk is a sedentary benthic species that attaches its eggs to the substrate during the egg-laying period. Development continues on the egg-laying site and there is no pelagic larval stage to help in dispersing of the young. These biological characteristics make whelk vulnerable to local overfishing.

To limit this risk, a minimum legal size of 70 mm has been in place since 2005 and the fishing season is limited to six months in all areas. There is also a quota on the number of traps allowed. In addition, a total allowable catch (TAC) was introduced in areas 1 and 2 in 2003, in area 15 in 2004 and in areas 11 to 13 in 2010. These conservation measures were adopted in order to better manage the fishing effort, to avoid overfishing and to better protect the reproductive potential.

The harvest of sexually immature individuals can also have negative impacts on the resource. It is therefore recommended that the minimum legal size be maintained in all areas and that the number of sublegal-size whelk continue to be reduced or even eliminated in landings.

The stabilization of indicators (CPUE and mean size measured at landing) in most areas since 2006 suggests that stock status was generally stable and that the current exploitation level is probably sustainable in current environmental conditions. The drop in effort between 2003 and 2006 theoretically favoured this stabilization of indicators.

To ensure conservation of this resource in the long term, we recommend directly controlling the fishing effort in all fishing areas because available whelk data cannot be used to assess the exploitable biomass of the various stocks. We therefore recommend limiting the effort to the average of the three highest values in the 2006–2011 series. If there is no fishing effort control, the rule stated earlier may be applied to landings. However, this last method will not necessarily ensure that the fishing effort is maintained. In the special case of areas 7 and 11 where the fishery is focused on only a small area, it would be better to explore and expand the fishing ground.

OTHER CONSIDERATIONS

The current selectivity of the traps does not permit the harvesting of only legal-size whelk. Consequently, sorting is done on board vessels. In order to limit incidence of mortality for sublegal-size whelk, it is important that they be handled with care and released back into the water as soon as possible and on their fishing ground. It is recommended that selective fishing gear and methods for handling sublegal-size whelk on board vessels be developed and used.

SOURCES OF INFORMATION

This Science Advisory Report is from the February 6, 2012, assessment of the whelk fishery in the Quebec's inshore waters. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

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